1. Voluntary Reporting 2000: An Overview

Introduction

The Energy Policy Act of 1992 (EPACT) directed the U.S. Department of Energy (DOE), with the Energy Information Administration (EIA) as the implementing agency, to develop a program to document voluntary actions that reduce emissions of greenhouse gases or remove greenhouse gases from the atmosphere (see box on page 2).[1] The Voluntary Reporting of Greenhouse Gases Program was developed in cooperation with DOE's Office of Policy and the U.S. Environmental Protection Agency (EPA). In addition to providing recognition for entities that reduce greenhouse gas emissions or sequester carbon voluntarily, the program serves to identify innovative and effective ways of reducing emissions.

To date, U.S. policy initiatives aimed at reducing greenhouse gas emissions have relied on voluntary approaches. The 1997 Climate Change Action Plan[2] sought to identify and implement actions that could reduce emissions of greenhouse gases through an array of government/industry partnerships. Most of the reporters to the Voluntary Reporting Program are affiliated with one or more government-sponsored voluntary programs.

This report presents information on the seventh reporting cycle of the Voluntary Reporting Program, which accepted reports including information on emissions, emission reductions, and carbon sequestration activities through 2000. The report is divided into seven chapters. This chapter provides an overview of participation in the Voluntary Reporting Program, a perspective on the composition of activities reported, and a review of some key issues in interpreting and evaluating achievements associated with reported emission mitigation initiatives. Chapters 2 through 6 provide a more detailed review of project-level emission reduction initiatives reported to the program. Chapter 2 examines projects in the electricity sector that reduce carbon dioxide emissions through thermal efficiency improvements or switching to lower emitting fossil fuels. Chapter 3 considers improvements in end-use efficiency and fuel switching in the residential, commercial, industrial, and transportation sectors.

Activities to improve or expand carbon sinks through such activities as reforestation, afforestation, and forest preservation are the subject of Chapter 4. Emission reduction initiatives associated with methane and halogenated substances are examined in Chapters 5 and 6, respectively. Chapter 7 reviews emissions reports from participants who provided data on aggregate entity emissions. A total of 100 reporters, including most of the largest electric utilities in the United States, provided information on aggregate (entity-level) emissions or reductions. Appendixes (available on web site *http://www.eia.doe.gov/oiaf/1605/vrrpt/index.html*) provide information on the development and structure of the data collection instrument, a discussion of issues in the interpretation of the data, and tabular summaries of the participating reporters and the information they reported.

The reports submitted to EIA are compiled into a database that can be obtained on CD-ROM by contacting the Voluntary Reporting of Greenhouse Gases Program Communications Center at 1-800-803-5182 or downloaded from EIA's web site at *http://www.eia.doe.gov/oiaf/1605/database.html*.

Benefits of the Voluntary Reporting Program

The Voluntary Reporting Program is unique among the many voluntary programs initiated during the early 1990s in its diversity of project types, participation, and approaches. The Voluntary Reporting Program's database provides abundant examples of the types of concrete actions that organizations can undertake to reduce greenhouse gas emissions. Some of the most important benefits of the Voluntary Reporting Program are:[3]

[1]Title XVI of the Energy Policy Act, Public Law 102-486 (October 24, 1992), in Section 1605(a) called for an annual report on national aggregate emissions of greenhouse gases. EIA has issued the report—*Emissions of Greenhouse Gases in the United States*—every year since 1993. Section 1605(b) called for the establishment of a database of annual emissions and reductions of emissions reported on a voluntary basis.

[2]U.S. Department of State, *Climate Action Report*, Publication 10496 (Washington, DC, July 1997), web site http://www.state.gov/www/global/oes/97climate_report/index.html.

[3]Testimony of Jay Hakes, former EIA Administrator, on March 30, 2000, before the Senate Committee on Energy and Natural Resources on Senate Bills S.882 and S.1776 and their potential impacts on EIA's Programs. The full text of the testimony is available on EIA's web site at http://www.eia.doe.gov/neic/speeches/hrtest3-30-00/testimony3.htm.

- The program has served to teach staff at many of the largest corporations in the United States how to estimate greenhouse gas emissions and has educated them on a range of possible measures to limit emissions.
- The program has helped to provide concrete evidence for the evaluation of activities reported to the many government voluntary programs launched since 1993.
- Reporters have been able to learn about innovative emission reduction activities from the experiences of their peers.
- The program has created a "test" database of approaches to emission reductions that can be used to evaluate future policy instruments aimed at limiting emissions.
- The program has helped to illuminate many of the poorly appreciated emissions accounting issues that must be addressed in designing any future approaches to emission limitations.

Who Reported?

Reports for the 2000 data year were received from 222 participants in 29 different industries or services, representing a continuing increase in both the number and diversity of participants. In comparison, reports for the 1994 data year—the first year of the program—were received from 108 participants in 9 different industries or services (Table 1).

The Energy Policy Act of 1992, Sections 1605(b) and (c)

(b) Voluntary Reporting.—

(1) ISSUANCE OF GUIDELINES.—Not later than 18 months after the date of the enactment of this Act, the Secretary shall, after opportunity for public comment, issue guidelines for the voluntary collection and reporting of information on sources of greenhouse gases. Such guidelines shall establish procedures for the accurate voluntary reporting of information on—

(A) greenhouse gas emissions—

(i) for the baseline period of 1987 through 1990; and

(ii) for subsequent calendar years on an annual basis;

(B) annual reductions of greenhouse gas emissions and carbon fixation achieved through any measures, including fuel switching, forest management practices, tree planting, use of renewable energy, manufacture or use of vehicles with reduced greenhouse gas emissions, appliance efficiency, methane recovery, cogeneration, chlorofluorocarbon capture and replacement, and power plant heat rate improvement;

(C) reductions in greenhouse gas emissions achieved as a result of—

(i) voluntary reductions;

(ii) plant or facility closings; and

(iii) State or Federal requirements; and

(D) an aggregate calculation of greenhouse gas emissions by each reporting entity.

Such guidelines shall also establish procedures for taking into account the differential radiative activity and atmospheric lifetimes of each greenhouse gas.

(2) REPORTING PROCEDURES.—The Administrator of the Energy Information Administration shall develop forms for voluntary reporting under the guidelines established under paragraph (1), and shall make such forms available to entities wishing to report such information. Persons reporting under this subsection shall certify the accuracy of the information reported.

(3) CONFIDENTIALITY.—Trade secret and commercial or financial information that is privileged or confidential shall be protected as provided in section 552(b)(4) of title 5, United States Code.

(4) ESTABLISHMENT OF DATA BASE.—Not later than 18 months after the date of the enactment of this Act, the Secretary through the Administrator of the Energy Information Administration shall establish a data base comprised of information voluntarily reported under this subsection. Such information may be used by the reporting entity to demonstrate achieved reductions of greenhouse gases.

(c) Consultation.—

In carrying out this section, the Secretary shall consult, as appropriate, with the Administrator of the Environmental Protection Agency.

Table 1. Forms Filed by Standard Industrial Classification, Data Years 1994-2000
(Number of Reports)

SIC Code[a]	Description	Data Year						
		1994	1995	1996	1997	1998	1999(R)	2000
01	Agricultural Production: Crops	0	0	0	0	1	0	0
08	Forestry	1	2	1	1	3	3	1
12	Coal Mining	1	2	2	1	4	3	4
14	Nonmetallic Minerals, except fuels	0	0	0	0	1	1	0
20	Food and Kindred Products	0	0	0	0	1	2	6
22	Textile Mill Products	0	0	0	0	0	1	5
23	Apparel and Other Textile Products	0	0	0	0	0	0	1
24	Lumber and Wood Products	0	0	0	0	0	0	1
25	Furniture and Fixtures	0	0	0	0	0	0	1
26	Paper and Allied Products	0	0	0	0	0	1	1
27	Printing and Publishing	0	1	0	1	0	1	1
28	Chemical and Allied Products	1	3	2	3	8	5	10
29	Petroleum Refining and Other Related Industries	0	0	2	3	8	9	6
30	Rubber and Miscellaneous Plastic Products	0	0	0	0	0	0	2
32	Stone, Clay, Glass, and Concrete Products	0	0	1	4	12	13	7
33	Primary Metals	2	2	4	4	5	5	5
34	Fabricated Metal Products, Except Machinery and Transportation Equipment	0	2	1	1	3	1	1
35	Industrial and Commercial Equipment and Components	0	0	0	0	0	0	1
36	Electronic Equipment	1	1	2	4	4	4	7
37	Transportation Equipment	1	1	1	2	3	5	4
38	Instruments and Related Products	0	0	0	0	2	0	1
39	Miscellaneous Manufacturing Industries	0	1	1	0	2	2	1
48	Communications	0	0	0	0	0	1	0
49	Electric, Gas, and Sanitary Services	95	121	125	129	138	135	145
57	Furniture and Home Furnishings Stores	0	0	0	0	2	1	1
65	Real Estate	0	1	1	1	1	1	1
67	Holding and Other Investment Offices	0	0	1	1	1	1	1
72	Personal Services	0	0	0	0	0	0	1
80	Health Services	0	0	0	0	1	0	0
82	Educational Services	1	2	2	2	0	2	0
86	Membership Organizations	0	0	0	1	1	1	1
87	Engineering and Management Services	0	0	2	2	2	1	0
88	Private Households	2	1	1	1	1	1	1
89	Services Not Elsewhere Classified	0	0	0	1	1	3	2
91	Executive, Legislative, and General	0	0	0	0	1	2	2
Total Number of Reporters[c]		**108**	**142**	**150**	**162**	**207**	**207[b]**	**222[b]**
Number of 2-Digit SIC Codes Represented		**9**	**13**	**16**	**18**	**24**	**26[b]**	**29[b]**

(R) = Revised.

[a]The Voluntary Reporting of Greenhouse Gases database was designed in 1994-1995, when the Standard Industrial Classification (SIC) system was still in use. For the 2002 data year reporting cycle, EIA intends to modify the database to use the North American Industry Classification System (NAICS), which was introduced in 1997 by the United States, Canada, and Mexico to provide comparability in statistics about business activity across North America.

[b]Includes six late reports for the 1999 data year. The 2000 total will also be revised upward in next year's report with the inclusion of late 2000 reports. As of December 21, 2001, EIA had received 12 late 2000 reports, which are not included in this report's 2000 database.

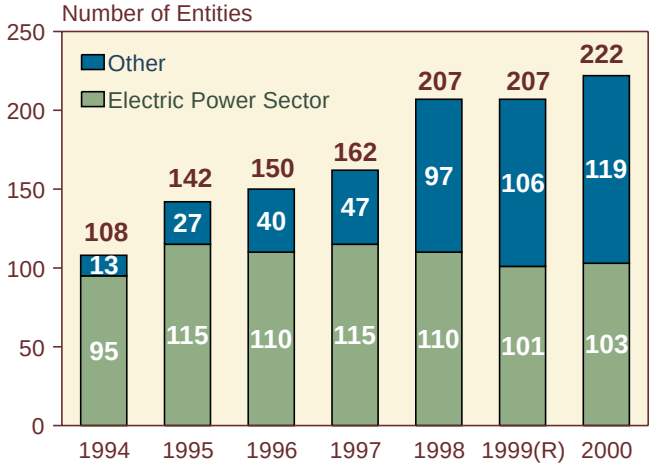
[c]Totals are greater than the sum of reporters in each SIC code, because confidential reporters are excluded from the latter.

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

The diversity of the participants in the Voluntary Reporting Program continued to increase in the 2000 data year. In the early years of the program, reporting was dominated by the electric power sector. In the first reporting year (data year 1994), the 95 submissions from electric power producers represented 88 percent of the 108 reports received (Figure 1). Since then, the program has seen an influx of new participants from outside the electric power sector, representing a diverse set of other industries. In addition, the ongoing restructuring of the electric power industry has been accompanied by several mergers and acquisitions involving reporters to the program, reducing the number of reports received from electricity producers. As a result, only 46 percent of the organizations reporting to the program for data year 2000 were from the electric power sector.

Although the number of reporters from other individual industries remained relatively small, in many cases, reports were received from key companies in those other industries: for example, General Motors in the automotive products industry; Noranda and an operating division of Alcan in the metals industry; BP, Sunoco, Inc., and Texaco, Inc., in the petroleum industry; DuPont, Johnson & Johnson, and The Dow Chemical Company in the chemicals industry; Rolls Royce in the aerospace industry; Pharmacia & Upjohn Caribe, Inc., in the pharmaceuticals industry; IBM and Motorola Austin in the electronic equipment industry; and a division of L´ORÉAL USA in the consumer products industry. A complete listing of all 2000 reporters is provided in Appendix B, Table B1.[4]

Figure 1. Electric Power Sector and Other Entities Submitting Reports to the Voluntary Reporting of Greenhouse Gases Program, Data Years 1994-2000



(R) = revised.

Notes: Electric power sector includes electric utilities and independent power producers. 1999 data year includes six late reports that were not included in the totals presented in last year's annual report and database.

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

Most reporters indicated that their projects were affiliated with one or more government-sponsored voluntary programs. Of the 1,882 projects reported for 2000, 1,034 were affiliated with the Climate Challenge Program, 162 with the Landfill Methane Outreach Program, 122 with the Climate Wise Recognition Program, 41 with the U.S. Initiative on Joint Implementation, 31 with various Energy Star programs (including Energy Star Buildings, Energy Star Computers, and Energy Star Transformers), 19 with the Green Lights Program, 8 with the Natural Gas STAR Program, 6 with the Sulfur Hexafluoride Emissions Reduction Partnership, 4 with the Coalbed Methane Outreach Program, and 3 with WasteWise. Other voluntary programs cited included the Voluntary Aluminum Industrial Partnership, Motor Challenge, the Compressed Air Challenge, and Rebuild America. Not all participants in the various voluntary programs provided information to the Voluntary Reporting Program.

What Was Reported?

The Voluntary Reporting Program permits three distinct types of reporting:

- Project-level emissions and reductions, defined as the emission reduction consequences of a particular action
- Entity-level emissions and reductions, defined as the emissions and reductions of an entire organization, usually defined as a corporation
- Commitments to take action to reduce emissions in the future.

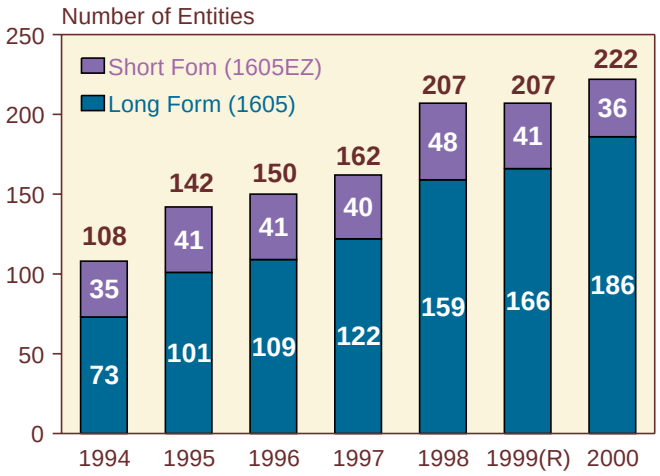
Of the 222 reports received, 186 (84 percent) were submitted on Form EIA-1605 (Figure 2). The remainder were submitted on Form EIA-1605EZ (the short form), which permits reporting on project-level reductions and sequestration only. The proportion of reporters using the short form has declined from 32 percent in the first year of the program (1994 data year) to 16 percent in the 2000 data reporting cycle. EIA believes that reporters are choosing the long form in order to document their emission reductions more thoroughly. Also, for the same reason, several voluntary programs such as Climate Wise and the Landfill Methane Outreach Program require or encourage participants to use the long form.

Most reporters (183 or 82 percent) reported project-level reductions, and 100 reported entity-level emissions and/or reductions. As these numbers imply, most (62)

[4]The appendixes to this report are available from web site http://www.eia.doe.gov/oiaf/1605/vrrpt/index.html.

of the reporters that reported entity-level emissions or reductions also reported at the project level. One hundred twenty-two organizations submitted only project-level reports, whereas 38 reported only entity-level information. Sixty-five reporters provided information on their commitments to reduce emissions or increase sequestration in the future.

Figure 2. Number of Reports Received by Form Type, Data Years 1994-2000



(R) = revised.

Note: 1999 data year includes six late reports that were not included in the totals presented in last year's annual report and database.

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

Sources of greenhouse gas emissions and emission reductions reported to the Voluntary Reporting of Greenhouse Gases Program are characterized as direct, indirect, or unspecified. The unspecified category includes carbon sequestration reported on the long form and all reductions and sequestration reported on the short form. Because of concern about possible double counting (see box on page 6), EIA does not aggregate reported emissions or emission reductions across the three categories.

Project Level

Reporters provided information on a total of 1,882 projects for 2000 (Table 2). The total number of projects reported increased by 160, or 9 percent, compared with the previous reporting cycle.[5] Most of the 1,882 projects reported for 2000 were also among the 1,722 projects reported for 1999, because they continued to yield emission reductions. Projects often yield emission reductions over an extended period of time; for example, an availability improvement project at a nuclear power plant typically involves the adoption of new maintenance and refueling programs that, once in place, are followed over a multi-year period. A project may even involve no new activity. The reforestation of an area in one year can result in the sequestration of carbon in many subsequent years, even if no additional trees are planted. Reporters continue to report the annual emission reductions and carbon sequestration achieved by such long-lived projects on a yearly basis.

Table 2. Distribution of Projects by Reduction Objective and Project Type, Data Year 2000

Reduction Objective and Project Type	Number of Projects	Number of Reporters
Reducing Carbon Dioxide Emissions	**976**	**125**
Electricity Generation, Transmission, and Distribution	462	93
Cogeneration and Waste Heat Recovery	18	13
Energy End Use	424	92
Transportation and Offroad Vehicles	72	41
Reducing Methane and Nitrous Oxide Emissions	**265**	**78**
Waste Treatment and Disposal (Methane)	234	59
Agriculture (Methane and Nitrous Oxide)	5	4
Oil and Natural Gas Systems and Coal Mining (Methane)	26	19
Carbon Sequestration	**494**	**66**
Halogenated Substances	**44**	**29**
Other Emission Reduction Projects	**103**	**57**
Entity-Level Reporting Only (No Projects)	**0**	**38**
Commitment Reporting Only (No Projects or Entity-Level Data)	**0**	**0**
Total	**1,882**	**222**

Note: The total number of reporters is smaller than the sum of the number of reporters for each project type, because most reporters provided information on more than one project.

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

[5]The number of projects reported for 1999 has increased from the 1,722 to 1,731 due to the receipt of several additional reports after, and revision of reports that had not been accepted by, the time the database used to prepare the annual report and Public Use Database for 1999 was finalized. See note to Table 3.

Double Reporting of Emission Reductions

Double reporting of emission reductions to the Voluntary Reporting of Greenhouse Gases Program can occur, because the ownership rights for such reductions may be claimed by more than one party. For example, both the manufacturers and owners of more efficient automobiles can claim emission reductions resulting from the operation of those vehicles (see page 19, "Who Owns the Reduction?"). Because the purpose of the Voluntary Reporting Program is to encourage reporting, EIA does not prohibit double reporting; however, EIA does endeavor to identify instances where double reporting may occur.

Reporters are required to distinguish between direct and indirect emissions and emission reductions on Form EIA-1605. Direct emissions are releases of greenhouse gases from sources owned (wholly or in part) or leased by the reporting entity. Indirect emissions are emissions from sources not owned or leased by the reporter that occur as a result of the reporter's activities. The most important indirect emissions are those associated with the consumption of electricity purchased from an electricity generator. Because the distinction between direct and indirect is unambiguous, direct emission reductions reported to the Program should include no double reporting; however, the application of the direct and indirect distinction is not comprehensive.

The reporting forms do not currently allow the reporter to indicate whether carbon sequestered through forestry projects is direct (occurring on land owned by the reporter) or indirect (occurring on land owned by others). Also, Form EIA-1605EZ does not distinguish between direct and indirect reductions. EIA intends to address these issues in future modifications of its reporting forms. To put this issue in perspective, of total project-level emission reductions for 2000, 69 percent (187 million metric tons carbon dioxide equivalent) are reported as direct emission reductions, 23 percent (61 million metric tons carbon dioxide equivalent) are reported as indirect emission reductions, and 8 percent (21 million metric tons carbon dioxide equivalent) are unspecified, reported as sequestration on the long form or as reductions or sequestration on the short form.

A second mechanism to identify possible double reporting is to require reporters using the long form to identify any other entity or entities that participate in a project reported to the Program. This captures situations where more than one entity is responsible for creating the emission reduction, such as landfill gas projects where the landfill owner, the owner of the power plant that uses the landfill gas, and the purchaser of the resulting power all can, and often do, report all the effects of the project. In the case of the landfill operator, for example, the methane captured at the landfill would be reported as a direct emission reduction, and the possible reduction in central-station fossil fuel power generation would be reported as an indirect emission. In contrast, the operator of the power plant could claim the emission reduction at the power plant as a direct reduction and the reduction in methane emissions at the landfill as an indirect reduction. In general, EIA believes that instances of double reporting of direct emissions are very rare if not nonexistent; however, double counting can be an issue for indirect reductions, because their ownership is not as clear cut.

Because of the concern that double reporting could result in double counting of emission reductions, EIA has discontinued reporting totals of all the reductions reported to the Program, in order to avoid giving the impression that the totals represent the cumulative effects of U.S.-sponsored projects on worldwide emissions of greenhouse gases. Emissions, emission reductions, and sequestration are disaggregated into the following categories: direct, indirect, and unspecified reductions and sequestration. Unspecified reductions and sequestration include sequestration reported on Form EIA-1605 and reductions and sequestration reported on Form EIA-1605EZ. As in the past, EIA does not combine reductions reported at the project level with those reported at the entity level, because the reported reductions represent the results of different approaches to estimating changes in greenhouse gas emissions.

EIA does not verify greenhouse gas emission reductions reported by participants, nor does it grant a property right associated with the claimed reductions. The Program requires, among other things, that the participants themselves certify that the information reported is accurate to the best of their knowledge and belief. Although EIA does review each report received for comprehensiveness, arithmetic accuracy, internal consistency, and plausibility and makes suggestions for improving the accuracy and clarity of reports, the reporter is ultimately responsible for the accuracy of any report submitted to the Voluntary Reporting Program.

Most projects involve actions within the United States; however, some are conducted in foreign countries, designed to test various concepts of joint implementation with other nations (Table 3). Sixty-six of the 97 foreign projects represent shares in two forestry programs in Belize and Malaysia sponsored by the electric utility industry.

The principal objective of the majority of projects reported for 2000 was to reduce carbon dioxide emissions (Table 2). Most of these projects reduced carbon dioxide either by reducing fossil fuel consumption or by switching to lower emitting sources of energy. Many also achieved small reductions in emissions of other gases. A total of 976 projects involved either efficiency improvements and switching to lower emitting energy sources in the electric power industry or energy end use measures affecting stationary or mobile combustion sources. Projects that also primarily reduced carbon dioxide emissions included the 103 "other" emission reduction projects, most of which involved either the reuse of fly ash as a cement substitute in concrete or the recycling of waste materials.

Projects that primarily affected carbon dioxide emissions accounted for reported direct reductions of 153 million tons carbon dioxide equivalent, representing 82 percent of the total direct reductions reported for 2000 on a carbon dioxide equivalent basis (Table 4). In addition, indirect reductions totaling 24 million metric tons carbon dioxide equivalent were also reported for the projects that reduced carbon dioxide emissions. A further 9 million metric tons carbon dioxide equivalent of unspecified reductions were reported on the short form (Form EIA-1605EZ), where the reporter is not asked to specify whether reductions or sequestration are direct or indirect.

Almost all of the 494 carbon sequestration projects reported on either the long form or the short form increased the amount of carbon stored in sinks through various forestry measures, including afforestation, reforestation, urban forestry, forest preservation, and modified forest management techniques. These activities accounted for 26 percent of the projects reported for 2000; however, 180 of the reported carbon sequestration projects represented shares in six projects conducted by the UtiliTree Carbon Company reported by 30 participating electric utilities. The sequestration reported for carbon sequestration projects for 2000 totaled 9 million tons of carbon dioxide on the long form and 5,000 metric tons of carbon dioxide on the short form. Direct emission reductions totaling 1,041 metric tons of carbon dioxide were also reported for a few projects where changes in forest management practices reduced fuel consumption.

A variety of efforts to reduce emissions of gases with high global warming potentials (GWPs) were also reported (see box on page 9). Two hundred sixty-five of the reported projects (14 percent) reduced methane and nitrous oxide emissions from waste management systems, animal husbandry operations, oil and gas systems, or coal mines. The 39 million metric tons carbon dioxide equivalent of direct methane reductions reported were offset by reported increases in carbon dioxide and nitrous oxide emissions totaling 10 million metric tons carbon dioxide equivalent. The carbon dioxide equivalent of the net reduction in direct emissions for projects that reduced methane and nitrous oxide emissions was 29 million metric tons, which represents 16 percent of the total direct reductions reported for 2000. Indirect reductions reported for projects that reduced methane and nitrous oxide emissions totaled 37 million metric tons carbon dioxide equivalent, and unspecified

Table 3. Geographic Scope of Reports Received and Location of Emission Reduction Projects, Data Years 1994-2000

	Reports Received				Projects Reported		
Year	U.S. Only	Foreign Only	Both U.S. and Foreign	Total[a]	U.S. Only	Foreign Only	Total[a]
1994	99	2	4	**108**	625	9	**645**
1995	122	2	16	**142**	924	36	**967**
1996	124	1	24	**150**	1,007	33	**1,040**
1997	130	1	31	**162**	1,216	72	**1,288**
1998	165	1	40	**207**	1,464	85	**1,557**
1999(R)	164	4	37	**207**	1,635	87	**1,731**
2000	177	1	43	**222**	1,785	97	**1,883**

[a]Totals are greater than the sum of the components because the latter exclude information from confidential reports.
(R) = revised
Note: The number of reports received for 1999 was revised to reflect the receipt of 6 reports after the finalization of the Public Use Database for last year's annual report. For 1999, additional reports were received from Atlas Paper Mills, County Sanitation Districts of Los Angeles County, Florida Transport 82, Consol Coal Group, Sherry Manufacturing, and Pine Mountain Oil and Gas, Inc. The number of projects reported for 1999 has also been revised to reflect the projects included in those reports.
Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

reductions and sequestration reported on the short form contributed emission reductions equal to another 3 million metric tons carbon dioxide equivalent.

Forty-four projects reduced emissions of halogenated substances, including perfluorocarbons (PFCs) and sulfur hexafluoride (SF_6). Unlike previous years, no

Table 4. Summary of Reported Project-Level Emission Reductions and Carbon Sequestration by Reduction Objective and Gas, Data Year 2000
(Metric Tons Carbon Dioxide Equivalent)

Gas	Reductions by Project Objective				Total Reductions
	Reduce Carbon Dioxide Emissions	Reduce Methane and Nitrous Oxide Emissions	Increase Carbon Sequestration	Reduce Emissions of Halogenated Substances	
Direct					
Carbon Dioxide	153,025,587	-9,714,505[a]	1,041	—	143,312,123
Methane	73,686	39,196,816	—	—	39,270,502
Nitrous Oxide	117,501	-3,357[a]	—	—	114,145
HFCs	—	—	—	—	—
PFCs	3,051	—	—	3,230,562	3,233,612
SF_6	—	—	—	1,407,347	1,407,347
Total Direct	**153,219,825**	**29,478,955**	**1,041**	**4,637,909**	**187,337,729**
Indirect					
Carbon Dioxide	23,746,902	16,458,997	—	—	40,205,899
Methane	118,090	20,523,490	—	—	20,641,581
Nitrous Oxide	26,263	89,419	—	—	115,683
HFCs	—	—	—	—	—
PFCs	35,360	—	—	—	35,360
SF_6	—	—	—	81	81
Total Indirect	**23,926,616**	**37,071,907**	**0**	**81**	**60,998,603**
Sequestration					
Carbon Dioxide	—	—	9,010,021	—	9,010,021
Methane	—	—	—	—	—
Nitrous Oxide	—	—	—	—	—
HFCs	—	—	—	—	—
PFCs	—	—	—	—	—
SF_6	—	—	—	—	—
Total Sequestration	**—**	**—**	**9,010,021**	**—**	**9,010,021**
Unspecified[b]					
Carbon Dioxide	9,089,102	29,051	5,081	—	9,123,235
Methane	70,531	3,057,230	—	—	3,127,762
Nitrous Oxide	—	—	—	—	0
HFCs	—	—	—	—	0
PFCs	—	—	—	—	0
SF_6	—	—	—	20,744	20,744
Total Unspecified	**9,159,634**	**3,086,281**	**5,081**	**20,744**	**12,271,740**

[a]Negative reductions represent increases in emissions.

[b]Unspecified emission reductions represent quantities reported on the short form (Form EIA-1605EZ), which does not distinguish between direct and indirect emission reductions or sequestration.

Notes: CFCs, HCFCs, and methyl chloroform are not included in the totals because of the uncertainty associated with estimates of net global warming potential for these gases. Their direct warming effects (radiative forcing) are offset by indirect cooling effects (destruction of stratospheric ozone, another greenhouse gas). Direct, indirect, and unspecified emission reductions and sequestration have not been totaled to avoid double counting of reductions or sequestration that have been reported by more than one entity.

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

offsetting increases in emissions of hydrofluorocarbons (HFCs)—which are used as substitutes for chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) being phased out under the Montreal Protocol—were reported for 2000. Direct reductions of PFC and SF_6 emissions totaled 5 million metric tons carbon dioxide equivalent, representing almost all the PFC and SF_6 emission reductions reported for 2000. Reductions of other gases, including carbon monoxide (CO), nonmethane volatile organic compounds (NMVOCs), chlorofluorocarbons (CFCs), and hydrochlorofluorocarbons (HCFCs), were reported, but these gases do not have reliable GWPs and are not included in the carbon dioxide equivalent data presented in this report (see box below).

Direct emission reductions reported for 2000 increased by 21 percent over the reductions reported for 1999, to 187 million metric tons carbon dioxide equivalent (Table 5), and have tripled since the first year of the program (data year 1994). Reported direct reductions of carbon dioxide emissions increased by 24 percent, to 143 million metric tons carbon dioxide equivalent. Large increases in direct reductions of SF_6 and nitrous oxide were also reported. Reported reductions of SF_6 and nitrous oxide increased by 136 percent and 84 percent, respectively, over the levels reported for 1999. Reported reductions of indirect emissions increased by 8 percent, to 61 million metric tons carbon dioxide equivalent. The sequestration reported peaked at 12 million metric tons for 1998 and has fallen below 10 million metric tons carbon dioxide for the two following years. This decline was caused by the decline in, or nonrecurrence of, sequestration reported for several large forest preservation initiatives. These projects avoided carbon releases associated with logging over the time period that the forests would have been harvested, which were reported as increased carbon sequestration over the same time period.

Unspecified reductions, which include reductions and sequestration reported on the short form (where reporters are not asked to specify whether reported reductions or sequestration quantities are direct or indirect), declined for the second straight year, falling to 12 million metric tons carbon dioxide equivalent in 2000. The primary reason for the large decline between 1998 and 1999 was that the PECO Energy Company, which reported reductions totaling 7.7 million metric tons on the short form in 1998, moved its report to the long form for 1999 and 2000.

Comparison of Global Warming Potentials from the Second and Third Assessment Reports of the Intergovernmental Panel on Climate Change

Global warming potentials (GWPs) are used to compare the abilities of different greenhouse gases to trap heat in the atmosphere. GWPs are based on the radiative efficiency (heat-absorbing ability) of each gas relative to that of carbon dioxide (CO_2), as well as the decay rate of each gas (the amount removed from the atmosphere over a given number of years) relative to that of CO_2. The GWP provides a construct for converting emissions of various gases into a common measure, which allows climate analysts to aggregate the radiative impacts of various greenhouse gases into a uniform measure denominated in carbon or carbon dioxide equivalents.

The generally accepted authority on GWPs is the Intergovernmental Panel on Climate Change (IPCC). In 2001, the IPCC updated its estimates of GWPs for key greenhouse gases. The table at the right compares the GWPs published in 1996 in the IPCC's Second Assessment Report[a] and those published in 2001 in the IPCC's Third Assessment Report.[b]

In summarizing the information reported to the Voluntary reporting of Greenhouse Gases Program for 2000, EIA has used the IPCC's revised GWPs to calculate carbon dioxide equivalents.

Comparison of 100-Year GWP Estimates from the IPCC's Second (1996) and Third (2001) Assessment Reports

Gas	1996 IPCC GWP	2001 IPCC GWP
Methane	21	23
Nitrous Oxide	310	296
HFC-23	11,700	12,000
HFC-125	2,800	3,400
HFC-134a	1,300	1,300
HFC-143a	3,800	4,300
HFC-152a	140	120
HFC-227ea	2,900	3,500
HFC-236fa	6,300	9,400
Perfluoromethane (CF_4)	6,500	5,700
Perfluoroethane (C_2F_6)	9,200	11,900
Sulfur Hexafluoride (SF_6)	23,900	22,200

[a]Intergovernmental Panel on Climate Change, *Climate Change 1995: The Science of Climate Change* (Cambridge, UK: Cambridge University Press, 1996).

[b]Intergovernmental Panel on Climate Change, *Climate Change 2001: The Scientific Basis. Summary for Policymakers* (Cambridge, UK: Cambridge University Press, 2001).

Project-Level Reference Cases

For the first time in this report series, EIA has broken out project-level data by the reference case employed in calculating project-specific reported emission reductions. A "reference case" is an emissions or sequestration level against which actual emissions are compared to estimate emission reductions. In a "basic" reference case, actual historical emissions (or sequestration) in a specific year, or an average of a range of years, are used as the

Table 5. Summary of Reported Project-Level Emission Reductions and Carbon Sequestration by Gas, Data Years 1994-2000
(Metric Tons Carbon Dioxide Equivalent)

Year	Carbon Dioxide	Methane	Nitrous Oxide	HFCs	PFCs	Sulfur Hexafluoride	Total
Direct							
1994 . . .	58,413,709	576,808	339,485	-29	3,199,649	83,579	**62,613,201**
1995 . . .	85,419,479	194,350	-438,673	-43	2,962,416	186,382	**88,323,910**
1996 . . .	77,601,577	9,411,042	-423,599	15,193	3,345,811	-69,985	**89,880,039**
1997 . . .	82,269,887	8,705,355	86,294	-42	3,318,600	516,732	**94,896,824**
1998 . . .	112,038,605	31,720,732	109,560	-1,738	3,504,380	624,786	**147,996,326**
1999(R). .	115,366,716	35,994,030	62,111	-1,738	3,425,480	595,379	**155,441,981**
2000 . . .	143,312,123	39,270,502	114,145	0	3,233,612	1,407,347	**187,337,729**
Indirect							
1994 . . .	2,994,405	2,360,734	2,234	—	—	—	**5,357,381**
1995 . . .	27,063,660	24,777,246	630,358	—	—	7,653	**52,478,917**
1996 . . .	26,207,709	26,612,114	616,075	—	—	—	**53,435,898**
1997 . . .	25,848,951	11,630,239	102,639	—	3,631	81	**37,585,541**
1998 . . .	27,968,865	15,152,664	105,598	—	6,068	81	**43,233,274**
1999(R). .	37,233,635	19,027,769	270,531	—	5,856	81	**56,537,872**
2000 . . .	40,205,899	20,641,581	115,683	—	35,360	81	**60,998,603**
Sequestration							
1994 . . .	746,545	—	—	—	—	—	**746,545**
1995 . . .	1,190,754	—	—	—	—	—	**1,190,754**
1996 . . .	8,676,591	—	—	—	—	—	**8,676,591**
1997 . . .	9,849,807	—	—	—	—	—	**9,849,807**
1998 . . .	12,490,927	—	—	—	—	—	**12,490,927**
1999(R). .	9,623,599	—	—	—	—	—	**9,623,599**
2000 . . .	9,010,021	—	—	—	—	—	**9,010,021**
Unspecified[a]							
1994 . . .	3,721,047	564,022	—	—	—	—	**4,285,069**
1995 . . .	4,959,366	1,162,752	—	—	—	—	**6,122,117**
1996 . . .	4,436,523	1,232,174	—	—	—	—	**5,668,697**
1997 . . .	6,688,175	1,825,383	—	—	123,049	—	**8,636,607**
1998 . . .	16,499,427	2,918,818	—	—	—	—	**19,418,245**
1999(R). .	9,607,428	3,273,878	—	—	—	4,783	**12,886,089**
2000 . . .	9,123,235	3,127,762	—	—	—	20,744	**12,271,740**

(R) = revised.

[a]Unspecified emission reductions represent quantities reported on the short form (Form EIA-1605EZ), which does not distinguish between direct and indirect emission reductions or sequestration.

Notes: Negative reductions represent increases in emissions. Reductions for a project may be reported as unspecified in one year and as direct or indirect reductions in another year if the reporter switches from using the short form (Form EIA-1605EZ) to the long form (Form EIA-1605). Reductions of CFCs, HCFCs, and methyl chloroform are not included in the totals because of the uncertainty associated with estimates of their net global warming potential. Their direct warming effects (positive radiative forcing) are offset by indirect cooling effects (destruction of stratospheric ozone, another greenhouse gas). Totals may not equal sum of components due to independent rounding. Direct, indirect, and unspecified emission reductions and sequestration have not been totaled, in order to avoid double counting of reductions or sequestration that have may been reported by more than one entity.

Source: Energy Information Administration, Forms EIA-1605 and EIA-1605EZ.

reference case. In a "modified" reference case, an estimate is made of what emissions or sequestration would have been in the absence of the project, and that estimate serves as the reference case.

The use of modified reference cases was reported for estimating reductions for 78 percent of the projects reported for 2000 on Form EIA-1605 (Table 6). A modified reference case is generally preferred for project-level analysis, because this approach attempts to isolate the effect of the action taken by the reporter from other factors that may have affected the reporter's emissions since the action was taken. The reported use of basic reference cases for 2000 was greatest for projects that reported carbon sequestration (40 percent) and halogenated substances (48 percent), because the techniques for evaluating reductions and sequestration for projects of those types are particularly suited to the use of basic reference cases. For forestry projects, carbon sequestration before and after the project is often assessed by sampling techniques to estimate the carbon stored in trees and soil within a defined area. For halogenated substances, emissions are determined using inventory management data, with emissions of a particular substance being equal to the amount purchased during the year to replace quantities emitted. Reductions can be calculated by subtracting the emissions in the years after emission abatement measures have been instituted from the emissions in the year before the measures were instituted.

In terms of emission reductions and sequestration reported for 2000, 153 million metric tons carbon dioxide equivalent of direct emissions (81 percent of total direct reductions), 56 million metric tons carbon dioxide equivalent of indirect emissions (92 percent of total indirect reductions), and 8 million metric tons carbon dioxide equivalent of sequestration (93 percent of total sequestration reductions) were reported as having been estimated using modified reference cases (Table 7). The project type categories where significant proportions of the reported direct reductions were estimated using basic reference cases were halogenated substances (97 percent) and transportation (76 percent).

Although modified reference cases, in terms of total projects and reported reductions, predominate, basic reference cases are still employed for a number of large projects. A basic reference case was used for estimating the 138,552 metric tons carbon dioxide equivalent indirect reduction reported by a single oil and natural gas system and coal mining project. The remaining eight projects in this category that reported reductions in indirect emissions together reported a net increase in indirect emissions. More than one-third (37 percent) of the reported indirect reductions for electricity generation transmission and distribution projects were calculated using basic reference cases. This was because several electric utilities reported nuclear-power-related projects that resulted in large reductions in power purchases and calculated the associated reductions in indirect emissions using basic reference cases.

Table 6. Number of Projects Reported on Form EIA-1605 by Reduction Objective and Project Type and Reference Case Employed, Data Year 2000
(Number of Projects)

Reduction Objective and Project Type	Modified		Basic		Total Number of Projects
	Number of Projects	Percent	Number of Projects	Percent	
Reducing Carbon Dioxide Emissions	**719**	**84**	**132**	**16**	**851**
Electricity Generation, Transmission, and Distribution	367	90	41	10	408
Cogeneration and Waste Heat Recovery	15	83	3	17	18
Energy End Use	281	77	83	23	364
Transportation and Offroad Vehicles	56	92	5	8	61
Reducing Methane and Nitrous Oxide Emissions	**212**	**96**	**9**	**4**	**221**
Waste Treatment and Disposal (Methane)	187	98	4	2	191
Agriculture (Methane and Nitrous Oxide)	5	100	0	0	5
Oil and Natural Gas Systems and Coal Mining (Methane)	20	80	5	20	25
Carbon Sequestration	**277**	**60**	**184**	**40**	**461**
Halogenated Substances	**22**	**52**	**20**	**48**	**42**
Other Emission Reduction Projects	**69**	**84**	**13**	**16**	**82**
Total	**1,299**	**78**	**358**	**22**	**1,657**

Note: Excludes projects reported on the short form (Form EIA-1605EZ), which does not collect information on the reference case employed. Excludes two projects reported on the long form (Form EIA-1605) for which no reference case was specified because reductions were not estimated.
Source: Energy Information Administration, Forms EIA-1605.

Modified references cases were used to estimate most (93 percent) of the sequestration reported for 2000, despite the fact that 40 percent of the projects reported using basic reference cases to estimate sequestration. The largest projects in terms of sequestration reported were forest preservation projects, for which basic reference cases cannot be used, because actual sequestration must be compared with a hypothetical scenario assuming that the forest has been harvested.

Entity Level

Most of the 100 reporters providing entity-level information included data on emissions as well as emission reductions or sequestration. Eight reporters provided entity-level data on emissions only, and another four reporters provided entity-level data on emission reductions or sequestration only.

Total entity-level direct emissions of carbon dioxide reported for 2000 were 1,008 million metric tons, which represents a 7-percent increase over the 946 million metric tons reported for 1999. Reported direct emissions of other gases, including methane, nitrous oxide, HFCs, PFCs, and SF_6, totaled 28.1 million metric tons carbon dioxide equivalent for 2000. Total entity-level direct emissions of these gases reported for 2000 were 27 percent lower than those reported for 1999. Total direct and indirect emissions reported at the entity level for each data year from 1994-2000 are summarized in Table 8.

Total direct emission reductions reported at the entity level have increased by 9 percent this year, from 150.0 million metric tons carbon dioxide equivalent for 1999 to 164.1 million metric tons carbon dioxide equivalent for 2000. In 2000, 122.4 million metric tons carbon dioxide equivalent (75 percent) of the reported direct reductions were estimated using modified reference cases, and 25 percent were estimated with basic reference cases.

Reported entity-level indirect emission reductions for 2000 totaled 27.8 million metric tons carbon dioxide equivalent. Reported indirect reductions of 34.6 million metric tons carbon dioxide equivalent calculated with modified reference cases were offset by -6.8 million metric tons carbon dioxide equivalent indirect reductions (i.e., net emission increase) calculated with basic reference cases. This represents a significant change from the previous reporting cycle, when indirect reductions estimated for 1999 using basic reference cases totaled 8.4 million metric tons carbon dioxide equivalent. This change was due primarily to the correction of 2000 data in two reports, which in the previous year had included indirect reductions totaling 14 million metric tons carbon dioxide equivalent that had been erroneously reported to have been estimated using basic reference cases.

Entity-level sequestration reported for 2000 decreased to 7.5 million metric tons carbon dioxide equivalent (11 percent) from the 8.4 million metric tons carbon dioxide equivalent reported for 1999.

Table 7. Reported Emission Reductions and Sequestration for Projects Reported on Form EIA-1605 by Reduction Objective, Project Type, Source, and Reference Case Employed, Data Year 2000
(Metric Tons Carbon Dioxide Equivalent)

Reduction Objective and Project Type	Direct Reductions		Indirect Reductions		Sequestration	
	Modified	Basic	Modified	Basic	Modified	Basic
Reducing Carbon Dioxide Emissions	**122,375,491**	**29,944,159**	**14,010,056**	**2,847,281**	**0**	**0**
Electricity Generation, Transmission, and Distribution	101,191,908	29,355,807	4,667,071	2,726,011	0	0
Cogeneration and Waste Heat Recovery	2,116,344	0	1,205,170	6,138	0	0
Energy End Use	19,061,936	571,744	8,024,072	113,018	0	0
Transportation and Offroad Vehicles	5,302	16,609	113,743	2,114	0	0
Reducing Methane and Nitrous Oxide Emissions	**29,194,016**	**284,939**	**35,563,298**	**1,508,609**	**0**	**0**
Waste Treatment and Disposal (Methane)	18,437,782	269,352	35,540,811	1,370,057	0	0
Agriculture (Methane and Nitrous Oxide)	269	0	23,993	0	0	0
Oil and Natural Gas Systems and Coal Mining (Methane)	10,755,965	15,587	-1,506	138,552	0	0
Carbon Sequestration	**1,041**	**0**	**0**	**0**	**8,421,864**	**588,158**
Halogenated Substances	**125,605**	**4,512,304**	**81**	**0**	**0**	**0**
Other Emission Reduction Projects	**900,175**	**0**	**6,377,558**	**691,721**	**0**	**0**
Total	**152,596,328**	**34,741,402**	**55,950,993**	**5,047,610**	**8,421,864**	**588,158**

Note: Excludes reductions and sequestration for projects reported on the short form (Form EIA-1605EZ), which does not collect information on the reference case employed.
Source: Energy Information Administration, Form EIA-1605.

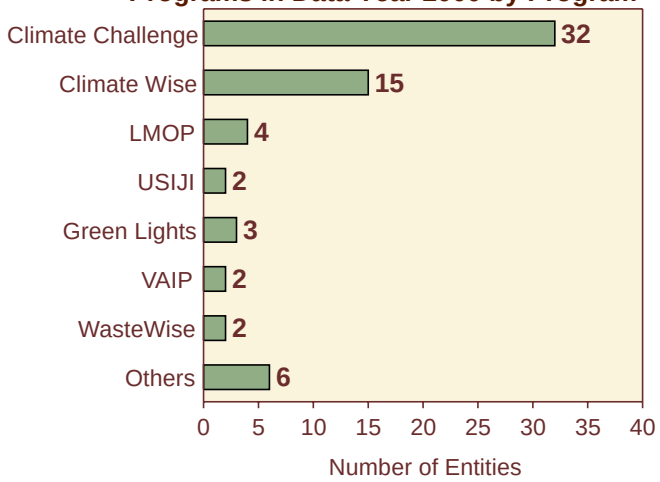
Commitments

Sixty-five entities reported formal commitments to reduce future emissions, to take action to reduce emissions in the future, or to provide financial support for activities related to greenhouse gas reductions.[6] Almost one-half (49 percent) of these entities are electricity generators participating in the Climate Challenge Program (Figure 3). Thirty-three non-Climate Challenge reporters also reported commitments. Other voluntary programs represented among the commitments reported for 2000 included Climate Wise, the Voluntary Aluminum Industrial Program, the U.S. Initiative on Joint Implementation, the Green Lights Program, the Landfill Methane Outreach Program, the Coalbed Methane Outreach Program, Cool Communities, Motor Challenge, the Sulfur Hexafluoride Emissions Reduction Partnership for Electric Power Systems, and WasteWise.

There are three forms of future commitment in the Voluntary Reporting Program: entity commitments, financial commitments, and project commitments. Entity and project commitments roughly parallel the entity and project aspects of emissions reporting: an entity commitment is a commitment to reduce the emissions of an entire organization; a project commitment is a commitment to take a particular action that will have the effect of reducing the reporter's emissions through a specific project. A financial commitment is a pledge to spend a particular sum of money on activities related to emission reductions, without a specific promise as to the emissions consequences of the expenditure.

Twenty-nine firms made 44 specific promises to reduce, avoid, or sequester future emissions at the entity level. Some of these entity-level commitments were to reduce emissions below a specific baseline, others to limit the growth of emissions per unit of output, and others to limit emissions by a specific amount relative to a baseline emissions growth trend. In their reports for 2000, companies committed to reducing future entity-level emissions by a total of 98.4 million metric tons carbon

Figure 3. Number of Entities Reporting Commitments Associated with Voluntary Programs in Data Year 2000 by Program



Notes: LMOP = Landfill Methane Outreach Program, USIJI = United States Initiative on Joint Implementation, VAIP = Voluntary Aluminum Industry Partnership. Others include Coalbed Methane Outreach Program, Cool Communities Program, Motor Challenge Program, and Sulfur Hexafluoride Emissions Reduction Partnership for Electric Power Systems. The sum of entities reporting commitments associated with each program exceeds the total number of entities reporting commitments because several entities reported commitments associated with more than one program.

Source: Energy Information Administration, Form EIA-1605.

Table 8. Number of Entities Reporting at the Entity Level and Reported Emissions, Emission Reductions by Source and Reference Case Employed, and Sequestration, Data Years 1994-2000
(Million Metric Tons Carbon Dioxide Equivalent)

Year	Number of Entities Reporting	Emissions		Emission Reductions by Type of Reference Case						Sequestration
				Direct			Indirect			
		Direct	Indirect	Modified	Basic	Total	Modified	Basic	Total	
1994	39	754.3	495.5	38.3	22.6	60.9	1.7	1.2	2.9	0.5
1995	50	878.2	501.0	56.1	39.3	95.4	46.1	2.7	48.7	0.8
1996	55	1,183.5	461.5	65.4	44.6	110.0	42.9	5.7	48.6	7.9
1997	60	1,006.6	525.8	73.7	20.3	94.0	24.8	3.4	28.2	7.1
1998	76	1,110.7	473.5	105.8	22.6	128.4	28.3	13.2	41.6	11.2
1999	83(R)	967.9	481.0	114.7	35.3	150.0	30.3	8.4	38.7	8.4
2000	100	1,036.1	107.1	122.4	41.7	164.1	34.6	-6.8	27.8	7.5

(R) = revised.

Note: 1999 data year includes one late report that was not included in the number of entities submitting 1999 data reports presented in last year's annual report and database.

Source: Energy Information Administration, Form EIA-1605.

[6]Fifty-nine companies reported formal commitments in one or more of the entity-level, project-level, or financial categories accommodated by Form EIA-1605. Six companies provided descriptions of future activities only in the Additional Information section of Schedule IV.

dioxide equivalent. More than one-third (39 percent) of entity-level emission reduction commitments were for the year 2000, with an additional 22 percent falling within the 2001 to 2005 time horizon.

Thirty-one companies reported on commitments to undertake 193 individual emission reductions projects. Some of the commitments were linked to future results from projects already underway and forming part of the reporters' submissions. Others were for projects not yet begun. Reporters indicated that the projects were expected to reduce future emissions by 160 million metric tons carbon dioxide equivalent, most of which (106 million metric tons carbon dioxide equivalent, or 66 percent) would be reductions of methane. This large increase in future project-level reductions of methane emissions is the result of a single commitment reported by Fidelity Exploration & Production Company, which expects that its gas recovery operations from yet-to-be-mined surface coal deposits in Montana and Wyoming will avoid methane emissions totaling more than 87 million metric tons carbon dioxide equivalent over the next 10 years.

Twenty-two firms made financial commitments. The total amount of funds promised was $18.6 million, of which $3.6 million was reported to have been expended in 2000.

Status of Policy Initiatives

The past year saw significant political shifts affecting climate change policy initiatives. Again in 2001, the 107th U.S. Congress did not pass any new climate change legislation relating to voluntary reporting or credit for early action, although several relevant bills were introduced (see below). In March, the Bush Administration announced that the United States would no longer support the Kyoto Protocol, arguing that it was "unfair and ineffective" because it excluded developing countries from reducing greenhouse gas emissions and would hurt the U.S. economy.[7] Nevertheless, as a result of a cabinet-level policy review and authoritative study by the National Academy of Sciences, the President announced a number of new initiatives to address climate change through international cooperation, research, and technology innovation.[8]

Although U.S. participation in the June 2001 continuation of the sixth Conference of Parties (COP-6 *bis*) in Bonn, Germany, was limited to UNFCCC negotiations, the other COP-6 parties eventually agreed on nearly all of the most contentious issues, including significant use of carbon sinks, establishing a compliance mechanism, and disallowing credit for nuclear facilities. During COP-7 in Marrakech, Morocco, Kyoto signatories agreed on operating rules for international emissions trading, the Clean Development Mechanism, and Joint Implementation; a compliance regime with penalties for failure to meet emissions targets; and a new type of emissions credit for sinks. COP-8 is scheduled for October 23 to November 1, 2002, with India as a possible location.[9] COP-8 will, among other things, review the adequacy of commitments under the Kyoto Protocol, including those of developing countries, with the intent to frame the issue for discussion at COP-9.

Legislation Relevant to Voluntary Reporting Introduced in the 107th U.S. Congress

Several bills pertaining to the 1605(b) Voluntary Reporting Program were introduced in the 107th Congress, mostly in the Senate.[10] In December 2001, Senators McCain (R-AZ) and Brownback (R-KS) introduced the Emissions Reductions Incentive Act of 2001 (S. 1781) to direct the Secretary of Commerce to establish a voluntary national registry system for greenhouse gas trading among industry, as well as other efforts supporting research and reporting on climate change issues. The functions of the registry would include designing programs to establish and report emissions baselines and reductions, maintaining a record of all verified emissions baselines and reductions, encouraging public participation in greenhouse gas emissions monitoring and reductions, and performing public outreach. Operating through an implementing panel created within the Department of Commerce, the national registry would serve as a central body to certify other Federal, State, and independent greenhouse gas registries and provide standards for participating greenhouse gas registries on the measurement, verification, and recording of greenhouse gas emissions and emission reductions. In particular, the standards would ensure that certified registries do not double count greenhouse gas emission reductions and would consider reductions from stationary sources, mobile sources, and as a result of carbon sequestration.

[7]Text of letter from Preident Bush to Senators Hagel, Helms, Craig, and Roberts (March 13, 2001), web site http://www.whitehouse.gov/releases/2001/03/20010314.html.

[8]President's Statement on Climate Change (July 13, 2001), web site http://www.whitehouse.gov/news/releases/2001/07/20010713-2.html.

[9]United Nations Framework Convention on Climate Change, "Governments Ready To Ratify Kyoto Protocol" (Press Release, November 10, 2001), web site http://unfccc.int/press/prel2001/pressrel101101.pdf.

[10]For more information about these bills, see the Library of Congress web site at http://thomas.loc.gov/.

Title XI of the Energy Policy Act of 2002 (S. 1766), introduced by Senators Daschle (D-SD) and Bingaman (D-NM) also in December 2001, calls for the establishment of a mandatory reporting system for greenhouse gas emissions through a negotiated rulemaking process under the direction of the Secretary of Commerce. The rules established under the rulemaking process would require any entity that exceeds the greenhouse gas emissions threshold of 1,000 metric tons carbon dioxide equivalent to report entity-wide emissions of greenhouse gases to the Secretary on an annual basis. The emissions data would be included in a National Greenhouse Gas Database, consisting of an inventory of greenhouse gas emissions and a registry of greenhouse gas emission reductions. Entities exceeding the emissions threshold would be required to submit comprehensive reports on their emissions, including both direct emissions (from stationary and mobile sources and any land use activities releasing significant quantities of greenhouse gases) and indirect emissions from such sources as purchased energy (e.g., electricity, steam, hot water), outsourced activities, contract manufacturing, and offsite waste management and disposal.

The rules proposed in S. 1766 would further establish reporting procedures and protocols for greenhouse gas emissions and emission reductions, provide for objective and independent verification of emissions or emission reductions, and consider how data reported under the Voluntary Reporting Program and other Federal and State registries could be reconciled with the National Greenhouse Gas Database. S. 1766 would also establish an Interagency Task Force responsible for advising the Secretary of Commerce on the design, operation, and improvement of the database. The Task Force would comprise the Secretaries of Energy, Agriculture, Interior, Commerce, and Transportation, the Administrator of the Environmental Protection Agency, the Chairman of the Council on Environmental Quality, and the Directors of the White House Offices of Science and Technology Policy and Climate Change Response.

Senators Kerry (D-MA), Stevens (R-AK), Hollings (D-SC), Inouye (D-HI), and others introduced the Global Climate Change Act of 2001 (S. 1716) in November 2001. This bill would introduce sweeping measures to address greenhouse gas measurement and reporting and climate change technology, science, and adaptation and would establish a National Office of Climate Change Action in the White House as well as an interagency Climate Change Action Task Force. The bill would authorize the National Institute of Standards and Technology to build on existing monitoring and reporting programs, such as the 1605(b) Program, to establish a national emissions measurement and verification system that would provide a standard method for establishing baselines, set uniform protocols to be used in State and international reporting systems, train third-party verifiers, and disseminate measurement and reporting techniques to the public. In conjunction with this system, the Task Force would create a Mandatory National Greenhouse Gas Reporting System under the Department of Commerce for industrial, energy-producing, and transportation entities generating significant greenhouse gas emissions. Reporting entities would be required to report direct and indirect emissions on an entity-wide and facility-by-facility basis, starting 4 years after enactment of the legislation. Failure to report would result in a daily penalty of $25,000 to a maximum of $200,000.

In August 2001, Senators Murkowski (R-AK), Craig (R-ID), Hagel (R-NE), Domenici (R-NM), and others introduced the Climate Change Risk Management Act of 2001 (S. 1294) to the Committee on Energy and Natural Resources. This bill would establish a new national policy to address climate change impacts and risks, seek to ensure long-term energy security, and strengthen provisions of other Acts addressing climate change. The bill would amend Section 1605(b) by requiring EIA to periodically review and revise the reporting guidelines, and to include an economic analysis as part of its review to ensure that any revisions are not excessively burdensome to participating reporters. Like many of the bills introduced in the Senate this year, the Murkowski bill includes provisions to promote carbon sequestration through forestry and agricultural activities. The bill would enhance the 1605(b) Program to make it more suitable for reporting forestry, agricultural, and international activities and would require DOE to create an annual recognition program for all participants in the Voluntary Reporting Program.

Senator Wyden (D-OR) sponsored two bills that address carbon sequestration. The Forest Resources for the Environment and the Economy Act (S. 820), cosponsored by Senator Craig, is designed to increase carbon sequestration in national forests and to facilitate voluntary reporting of relevant forest projects. Like S. 1294, this bill would amend the Energy Policy Act of 1992 to enhance voluntary reporting, monitoring, and verifying carbon storage activities using Voluntary Reporting Program guidelines, but under the authority of the U.S. Department of Agriculture (USDA). The bill would also establish a Carbon and Forestry Advisory Council in the USDA to oversee the reporting process and assess forest vulnerability to long-term climate impacts and would require States and participants in Federal cooperative agreements to monitor, verify, and report on carbon sequestration activities to the Secretary of Agriculture. Senator Wyden also introduced a similar bill, the Carbon Sequestration and Reporting Act (S. 1255), cosponsored by Senator Brownback, which would create a Carbon Advisory Council in DOE to provide recommendations on specific changes to Section 1605(b) of the

Energy Policy Act regarding voluntary reporting on carbon sequestration practices in the United States resulting from tree planting, forest management actions, and management of agricultural land.

Senator Brownback sponsored three other bills promoting carbon sequestration through forestry and agricultural activities. Introduced in April 2001 and cosponsored by Senators Reid (D-NV), Lugar (R-IN), and DeWine (R-OH), the International Carbon Conservation Act (S. 769) would establish a panel within the Department of Commerce to enhance international conservation, promote sequestration, and encourage voluntary efforts related to climate change. Under the bill, the Forest Service would apply experience gained under the 1605(b) Voluntary Reporting Program to develop reporting guidelines for the international carbon sequestration projects. EIA and the USDA would jointly develop reporting forms to determine carbon sequestration improvements, carbon sequestration practices, and compliance under the program.

The Carbon Conservation Incentive Act (S. 785), cosponsored with Senators Murkowski and Johnson (D-SD), would amend the Food Security Act of 1985 to require the USDA to establish a program to increase carbon sequestration by land owners and operators. The bill would similarly create an advisory panel to oversee the acceptability and evaluation of carbon sequestration activities, estimating carbon sequestration rates on the basis of information reported under Section 1605(b). Another portion of the bill would have the USDA and EIA develop forms to monitor sequestration improvements and report to EIA on the improvements and the sequestration practices carried out as a result of the program. The related Carbon Sequestration Investment Tax Act (S. 765) would create a tax credit for investments in international carbon sequestration projects initiated under S. 769.

In August 2001, Senators Craig and Hagel introduced the Climate Change Tax Amendments of 2001 (S. 1293), a bill that would amend the Internal Revenue Code of 1986 to provide incentives for the voluntary reduction, avoidance, and sequestration of greenhouse gas emissions and to advance global climate change science and technology development and deployment. Tax incentives granted under the law would be based on information reported and certified under the 1605(b) Program.

In the House, Rep. Allen (D-ME) and a number of other representatives introduced the Clean Power Plant Act of 2001 (H.R. 1335), which would seek to reduce various airborne emissions, including carbon dioxide, from fossil-fuel-fired electric power plants and establish a cap and trade system for carbon dioxide emissions. In the Senate, Senator Leahy (D-VT) introduced the related Clean Power Plant and Modernization Act of 2001 (S. 1131), which included provisions on reducing and reporting on carbon dioxide emissions in the U.S. energy sector.

State Initiatives

A growing number of U.S. States are undertaking legislative initiatives on voluntary greenhouse gas reporting. In 2001, California, New Hampshire, and Wisconsin took further steps to develop rules for voluntary reporting; Maine adopted new legislation to create a greenhouse gas registry; and two regional initiatives were announced. Maryland, New York, and Rhode Island have also taken preliminary steps to consider developing voluntary registries.

Efforts continued in California to establish the California Climate Action Registry under Senate Bill (SB) 1771,[11] adopted in September 2000, to provide for entity-wide voluntary reporting on greenhouse gas emissions. The State began staffing the Registry in the past year, and in September 2001 Governor Davis announced four of the five appointed members of the Registry's Board of Directors. Refinements to the original registry legislation were also approved through SB 527,[12] signed by the Governor on October 11, 2001. Under the legislative direction of SB 527, the newly formed Registry must identify the information it will require its participants to report, what industry-specific metrics it will require the participants to use in reporting the information, and how the reported information will be certified.

SB 527 changes SB 1771 by requiring participants to report direct and indirect emissions separately. Participants are no longer required to report emissions baselines and annual emissions results expressed as a fraction in terms of emissions efficiency rates (such as carbon dioxide per dollar of revenue, per kilowatthour of electricity generated, or per dollar of budgetary expenditure), emissions in relation to the annual business-as-usual rate of improvement in energy efficiency, or *de minimis* emissions. In addition, the Registry, in coordination with the State energy commission, may revise the scope of indirect emissions source types that participants may be required to report after a public workshop and review process. The new law upholds many of the existing provisions, including the requirement that organizations report on an entity-wide basis.

[11]The text of this bill can be found at web site http://leginfo.public.ca.gov/pub/99-00/bill/asm/ab_1751-1800/ab_1771_bill_20000923_chaptered.pdf.

[12]The text of this bill can be found at web site http://www.leginfo.ca.gov/pub/bill/sen/sb_0501-0550/sb_527_bill_20011012_chaptered.html.

On February 23, 2001, the Division of Air Resources in New Hampshire's Department of Environmental Services adopted Env-A 3800,[13] the final administrative rules implementing the State's 1999 greenhouse gas registry law.[14] Env-A 3800 provides basic guidance on registering voluntary emissions reductions (VERs) for any entity located in New Hampshire that reduces greenhouse gas emissions in or out of the State. The rules require VERs to be computed in accordance with the general guidelines for the Voluntary Reporting of Greenhouse Gases Program,[15] using the specific protocols provided for Forms EIA-1605 and EIA-1605EZ, and in reference to EPA's publication, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-1997*. Alternative protocols are permitted, however, with the approval of the Department of Environmental Services. In addition, in anticipation of possible future greenhouse gas emissions trading, the rules require all participants to maintain detailed records documenting the quantification protocols used to calculate the VERs, and to transfer documents when VER ownership is turned over to another entity.

The Wisconsin Department of Natural Resources has been developing rules to implement Senate Bill 287,[16] which requires the Department to establish and operate a registry of greenhouse gas VERs as well as fine particulate matter, mercury, and other air contaminants. The draft rules establish a registration system for actions that occur wholly within the State of Wisconsin and that exceed a minimum emission reduction threshold that depends on the contaminant. Like New Hampshire, Wisconsin permits reporting on a project, facility, or system-wide basis but limits reporting to activities within the State. The Department permits the use of 10 different reporting protocols, including DOE's 1605(b) Voluntary Reporting Program, for organizations to report VERs. Reporting entities may also submit annual 1605(b) reporting forms to the Department in lieu of using the Department's forms. As in other States, VERs calculated using alternative protocols may also be submitted.

In March 2001, the Maine State Legislature adopted Legislative Document 87,[17] a law requiring the State's Department of Environmental Protection (DEP) to create a voluntary registry of greenhouse gas emissions. The registry must provide for the collection of data on the origin of carbon dioxide emissions as either fossil fuel or renewable resources and for the collection of information on production activity to allow for the tracking of future emissions trends. The DEP is developing guidelines to establish the registry and is expected to submit them to the State legislature by December 2001.

The governors of six New England States[18] and premiers of five Canadian Provinces[19] adopted an action plan on global climate change that calls for the creation of a regional greenhouse gas registry in conjunction with efforts to explore a regional trading regime. An important goal of the action plan is for the States and provinces to give industries and other entities reporting to the registry the ability to disclose their current emissions baselines in order to ensure credit for early action.[20] As part of its Greenhouse Gas Emissions Trading Demonstration Project, Northeast States for Coordinated Air Use Management (NESCAUM)[21] also recently announced its plans to develop a model, regional greenhouse gas emission reduction registry that will complement existing State efforts to create early action registries.

Accounting Issues for Voluntary Reporting and Beyond

The Voluntary Reporting of Greenhouse Gases Program was designed primarily to serve as a mechanism by which entities could report voluntary actions intended to reduce greenhouse gas emissions and sequester carbon.[22] EIA has the responsibility, among other things, for establishing and maintaining a database of reported greenhouse reductions that also serves as a national registry of reported reductions. While the information in the database may be used by the reporting entity to demonstrate achieved reductions of greenhouse gases, the program was not designed to support credit for early reductions or emissions trading programs. The program

[13] The text of these rules can be found at web site http://www.des.state.nh.us/rules/enva-3800.PDF.

[14] Voluntary Greenhouse Gas Registry (SB-159).

[15] U.S. Department of Energy, *Voluntary Reporting of Greenhouse Gases under Section 1605(b) of the Energy Policy Act of 1992, General Guidelines*, DOE/PO-0028, Volume 1 of 3 (Washington, DC, October 1994), web site http://www.eia.doe.gov/oiaf/1605/guidelns.html.

[16] The text of this bill can be found at web site http://www.4cleanair.org/members/committee/ozone/WiscEER.PDF.

[17] The text of this legislation can be found at web site http://janus.state.me.us/legis/bills/billtexts/LD008701-1.asp.

[18] Connecticut, Maine, Massachusetts, New Hampshire, Rhode island, and Vermont.

[19] New Brunswick, Newfoundland and Labrador, Nova Scotia, Prince Edward Island, and Quebec.

[20] Green House Network, *EPA U.S. and Canadian Leaders Adopt Climate Action Plan* (August 28, 2001), web site http://www.greenhousenet.org/news/august-2001/actionplan.html.

[21] NESCAUM is an interstate association of State air quality control divisions representing the six New England States, as well as New York and New Jersey.

[22] This discussion of accounting issues is based on testimony given by Jay Hakes, former EIA Administrator, on March 30, 2000, before the Senate Committee on Energy and Natural Resources on Senate Bills S. 882 and S. 1776 and their potential impacts on EIA's Programs. The full text of the testimony is available on EIA's web site at http://www.eia.doe.gov/neic/speeches/hrtest3-30-00/testimony3.htm.

guidelines did not attempt to resolve the issues that arise in constructing the required reporting rules that would create a set of comparable, verifiable, auditable emission and reduction reports. Such rules would also be required for the flexible mechanisms, such as the Clean Development Mechanism, Activities Implemented Jointly, and Joint Implementation, included in the United Nations Framework Convention on Climate Change and its Kyoto Protocol.

The Voluntary Reporting of Greenhouse Gases Program allows reporters considerable flexibility in the scope and content of their reports. As a result, companies can report their emissions and reductions in several different ways, and potentially more than one reporter can claim the same reduction. Some commentators on the program have characterized this aspect as a defect: a problem needing a solution. A more restrictive program, however, could limit the number of entities reporting, as well as the types of activities reported. Therefore, because it tends to increase participation in voluntary reporting, flexibility can be viewed as a useful attribute of the program for the following reasons:

- The educational and public recognition aspects of the program are enhanced by maximizing the participation and do not necessarily require a complete and fully-defined system of property rights to a reported emission reduction.
- The Voluntary Reporting Program can be viewed as a survey of emission accounting methods and theories actually in use, and a set of illustrations of the potential accounting and baseline problems that must be confronted in designing future policy instruments. A more structured approach might have been less useful for identifying and analyzing these emissions accounting issues.
- The Voluntary Reporting database illustrates the range and diversity of concrete actions that firms can undertake to limit greenhouse gas emissions, including many not imagined by the designers of the program. A more structured approach might have excluded some of the more original and innovative projects reported to the program.

These features make the Voluntary Reporting Program useful in evaluating the design and consequences of any proposed credit for early action program as well as the Kyoto Protocol's flexible mechanisms. By creating a database of real-world emission reduction actions and actors, the data reported to the Voluntary Reporting Program can be used to gain insight into the incentive effects and beneficiaries of various credit for early action and related proposals. The Voluntary Reporting of Greenhouse Gases database has provided a mechanism for identifying some of the issues that would have to be resolved in developing an accounting system for quantifying emissions, emission reductions, and sequestration. Such an accounting system will have to answer the following questions:

- Who can report?
- What is a reduction?
- Who owns the reduction?
- Would the reduction have happened anyway?
- How does one verify reports?

Who Can Report?

Section 1605(b) of the Energy Policy Act of 1992 mentioned only "entities" and "persons" as prospective reporters. Several overlapping concepts of "who can report" surfaced at the public hearings for the guidelines for the Voluntary Reporting Program, all of which were accommodated. These included:

- **A legal person: i.e., an individual, household, corporation, or trade association.** In this approach, emissions and reductions are calculated and reported at the corporate level.
- **A facility or group of facilities.** Emissions and reductions are calculated as those of a particular facility, defined as a single plant in a specified location, or perhaps even a single stack within a plant. A corporation or legal person acquires responsibility for emissions and reductions through ownership of one or more specified facilities.
- **A "project" or activity.** Reductions are defined by comparing the emissions from some set of sources deemed relevant with an estimate of what emissions would have been if a particular action or bundle of actions had not been undertaken.

What is a Reduction?

Perhaps the most intuitive definition of a reduction is one measured against an historical baseline, which represents the use of a "basic reference case." In this approach, the reduction is defined as the difference between the emissions of an entity or facility in a prior, baseline year, usually 1990, and in the current year. This approach is best suited to reporters whose activities have not appreciably changed since the baseline year. It presents particular problems for firms that have participated in mergers, acquisitions, or divestitures, or have made significant changes in the composition of their business. Startup companies or new facilities that have no history cannot use historical baselines. The historical baseline approach is also not well suited to measuring the reductions achieved by projects, because projects are often entirely new activities with no history.

Alternatively, many reporters define their reductions by comparison with what would have happened in the absence of a specified set of actions. Thus, corporate emissions may have risen, but they are less than they would have been in the absence of corporate action. This approach is called, in the Voluntary Reporting Program, a "modified reference case" or a "hypothetical baseline." It is important to point out, however, that a hypothetical baseline is a best guess of what would have happened in the absence of a project, and there is no way *per se* to prove or disprove it. Most of the projects reported to the Voluntary Reporting Program use a hypothetical baseline to calculate emission reductions or sequestration.

The "unit of production" approach is a variant of the fixed historical baseline, where the reporter normalizes baseline emissions to reflect changes in production. If emissions per unit of output have declined, by comparison either with levels in a prior year or with what they would have been in the absence of some actions, then the reporter has a reduction. This approach works reasonably well for organizations that have a well-defined product that is homogeneous across companies and over time: for example, kilowatthours generated or sold, tons of steel, or barrels of crude oil. As products increase in complexity, this approach gradually breaks down. Tons of semiconductors, for example, is a meaningless measure of output.

The alternative measures of reductions have their advantages and disadvantages. Basic reference cases are objective and relatively easily verifiable. On the other hand, absolute reductions are often the product of circumstance rather than action, while modified reference cases (which are more difficult to verify) explicitly measure the results of actions. Unit-of-production reference cases are useful only in a limited number of cases, and they can combine some of the disadvantages of both basic and modified reference cases.

Who Owns the Reduction?

Two theories of emissions ownership coexist in the Voluntary Reporting Program. The most intuitive, and commonplace, is called "direct emissions" and "direct reductions." If a reporter owns or uses (e.g., leases) the emission source, that reporter owns the emission as well as any reductions from this source. The advantage of limiting ownership to direct emissions is that it generally prevents multiple ownership of the same emission or reduction. However, this approach excludes many important emission reduction methods, including all activities that tend to reduce electricity consumption, the activities of energy service companies, and the provision of energy-efficient or emission reducing capital goods.

The alternative theory of ownership is based on causation: if an organization causes an emission or reduction, it is responsible for that emission, even if it does not own the emission source. Emissions or reductions from sources not owned by the reporter are referred to as "indirect." The most important example of indirect emissions is those produced through the consumption of electricity. If entities reduce their consumption of electricity, they cause their electric utility to reduce its emissions. This approach permits reporting of any action that has an influence on national emissions. However, the concept of "causing an emission" is inherently more ambiguous than "owning the smoke stack," and in many cases more than one firm may credibly claim to have helped cause an emission reduction.

EIA requires that reporters using Form EIA-1605 explicitly identify all emissions and reductions as either direct or indirect so that potentially double-counted reductions can be identified.

Would the Reduction Have Happened Anyway?

This issue is often discussed in other contexts under the term "additionality." It has been suggested that many emission reduction projects do not represent "real" reductions because they would have been undertaken "anyway" in the normal course of business. However, creating an operational definition of additionality is difficult, because the "normal course of business" is a hypothetical concept. For the purposes of voluntary reporting—which include publicizing the types of actions that limit national greenhouse gas emissions and providing recognition for the companies that undertake those actions voluntarily—determining the additionality of projects is unnecessary. For the purposes of a credit for early reduction program, however, additionality is an issue that needs to be considered.

How Does One Verify Reports?

The Department of Energy decided not to require verification by an independent third party after considering this issue during the development of the guidelines for the Voluntary Reporting Program. However, reporters must certify the accuracy of their 1605(b) reports. Also, filing a false statement on a U.S. Government form is illegal. EIA reviews each report received for comprehensiveness, arithmetic accuracy, internal consistency, and plausibility and makes suggestions for improving the accuracy and clarity of reports; however, the reporter is ultimately responsible for the accuracy of any report submitted to the Voluntary Reporting Program.

In general, reports submitted to EIA are factually accurate. Meaningful verification of the accuracy of 1605(b)

reporting would require putting in place common baselines and accounting standards that dictate what information should be included in 1605(b) reports and how estimates of greenhouse gas emissions and reductions and carbon sequestration should be calculated. For example, if the accounting treatment for indirect emissions from electricity purchases is undefined, then a particular set of facts about a reporter could result in two different estimates of emissions: one including electricity purchases and one excluding electricity purchases. A third-party verifier can verify the facts about the reporter but cannot determine whether or not indirect emissions from electricity purchases ought to be included and, consequently, cannot determine whether the total emissions reported are correct or not.